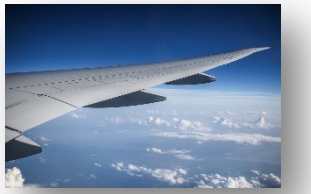
Federal Aviation Administration

National Airspace System Surveillance

United States National Airspace System (NAS) Operations



- 5,300,000 square miles of U.S. domestic airspace
- 24,100,000 square miles of oceanic airspace

- 14,000 (plus) Air Traffic Controllers
  - 520 Air Traffic Control Towers
  - 147 Terminal Approach Control Facilities
  - 21 Air Route Traffic Control Centers

- 19,633 airports

https://www.faa.gov/air_traffic/by_the_numbers/

United States NAS Operations (continued)

Air Traffic Services are provided by Controllers who rely on various systems to safely and efficiently guide aircraft from gate to gate, and in doing so, transitioning from different airspace domains (Surface, Terminal and En-Route).

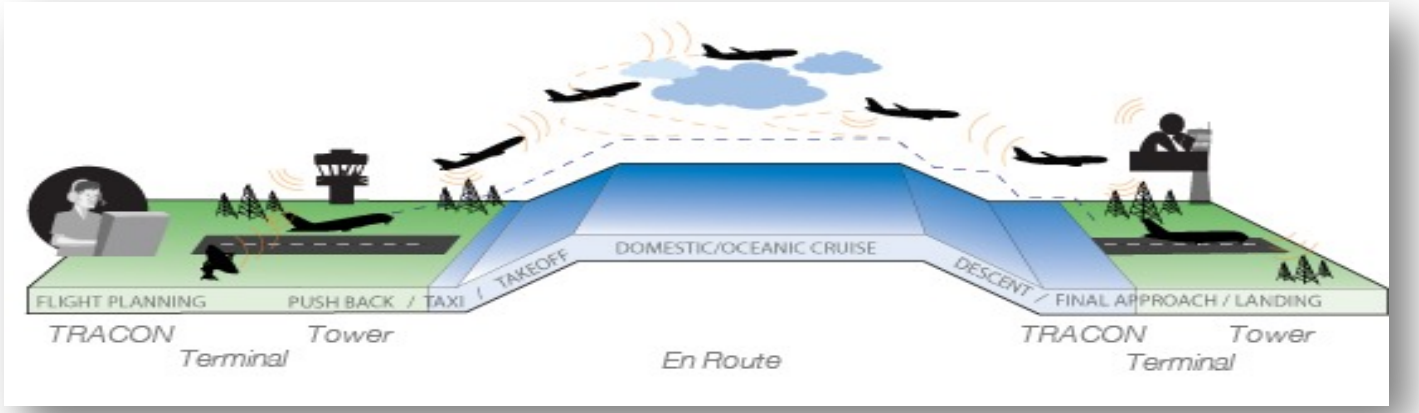


Image of an Aircraft Transitioning from Different Airspace Domains (e.g., Terminal, En-Route)

FAA by the Numbers

- 16,405,000 flights handled by the FAA yearly
- 45,000 average daily flights handled by the FAA
  - 5,400 aircraft in the sky at peak time
- 25,506,000 General Aviation flight Hours per year
- Aviation contributed 5.2% of the U.S. gross domestic product (GDP)
  - $488 Billion annual earnings from aviation

https://www.faa.gov/air_traffic/by_the_numbers/

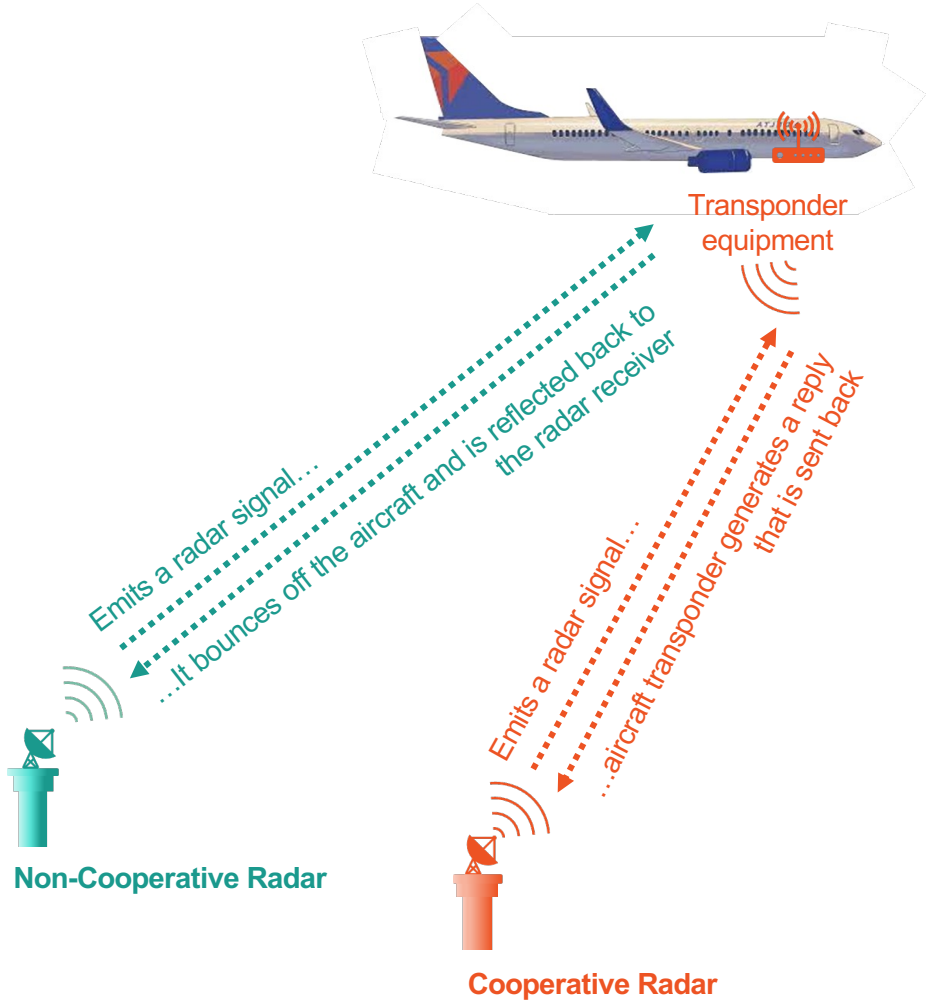
Surveillance Services Categories

Cooperative Surveillance - Requires avionics on board the aircraft that work in coordination with ground-based systems to determine the aircraft position, altitude, and identity.

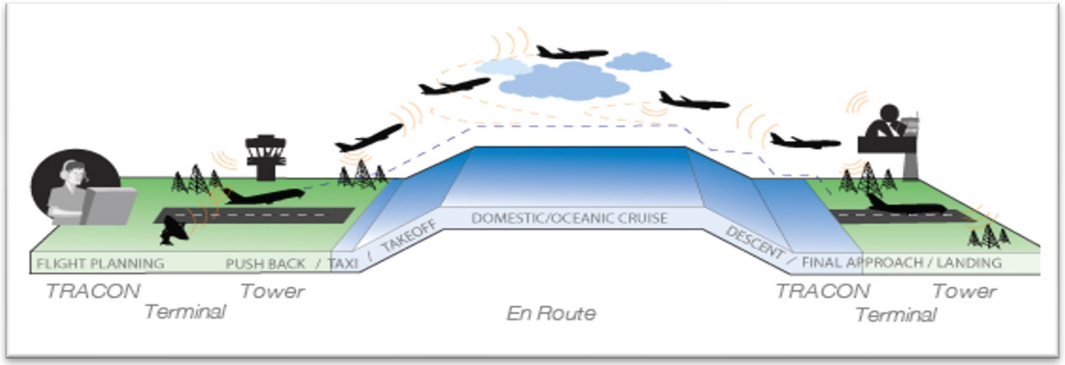
- A second radar beacon antenna attached to the top of non-cooperative radar antenna transmits and receives aircraft data for barometric altitude, identification code, and emergency condition.

Non-Cooperative Surveillance – Determines an aircraft's position independently, without the use of on-board avionics.

- Track aircraft not equipped with avionics or with failed avionics
- Provide air traffic control weather information



Types of Surveillance Systems



Short-Range Radar – Non-cooperative and Cooperative sensors

- Coverage: 40 to 60 nautical mile (NM) ranges from the radar sensor
- Use:
  - Control aircraft in Terminal airspace around airports
  - Gap filler coverage of En-Route airspace where long-range radars not available

Long-Range Radar – Non-cooperative and Cooperative sensors

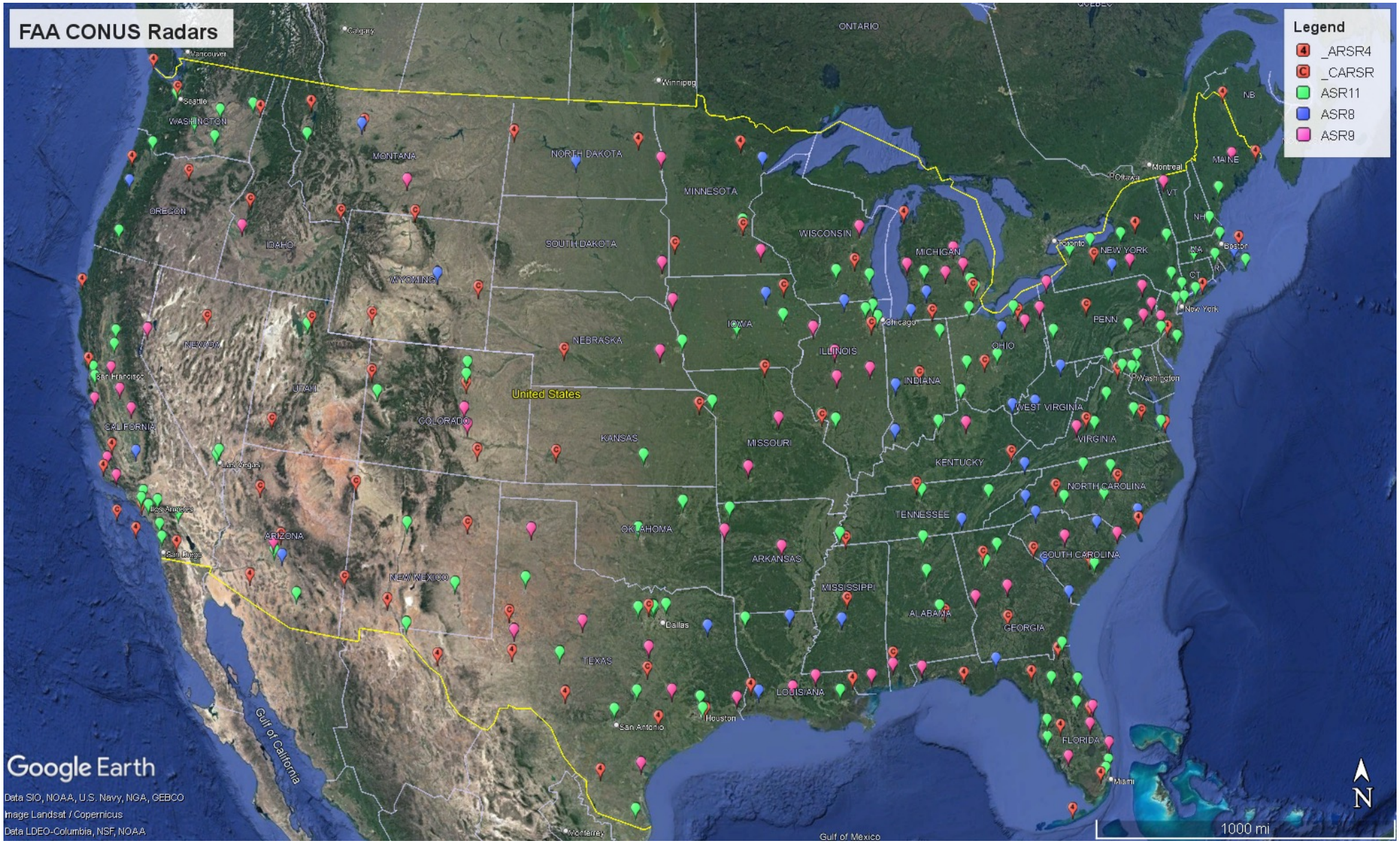
- Coverage: 200 to 250 NM nautical miles (NM) from the radar sensor
- Use:
  - Control aircraft in En-Route airspace to flying between 18,000 and 60,000 feet above sea level (Class A airspace)
  - Some coverage of Terminal airspaces where short-range radars not available

Automatic Dependent Surveillance-Broadcast (ADS-B) – Cooperative (ADS-B equipped aircraft position via Satellite GPS)

- Coverage: Over 600 ground stations across the US - No range limitations within ground station coverage
- Use:
  - Control aircraft in Surface, Terminal and En-Route airspace
  - Aircraft position data very accurate and high update rate

Surface Surveillance – Non-cooperative and Cooperative

- Coverage: Airports surface and on approach and departure paths
- Use:
  - Provides situational awareness on the airport movement areas and 1-2 miles into approach corridors


FAA CONUS Radars
Legend
_ARSR4
_CARSR
ASR11
ASR8
ASR9
United States
Gulf of California
Gulf of Mexico
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Data LDEO-Columbia, NSF, NOAA
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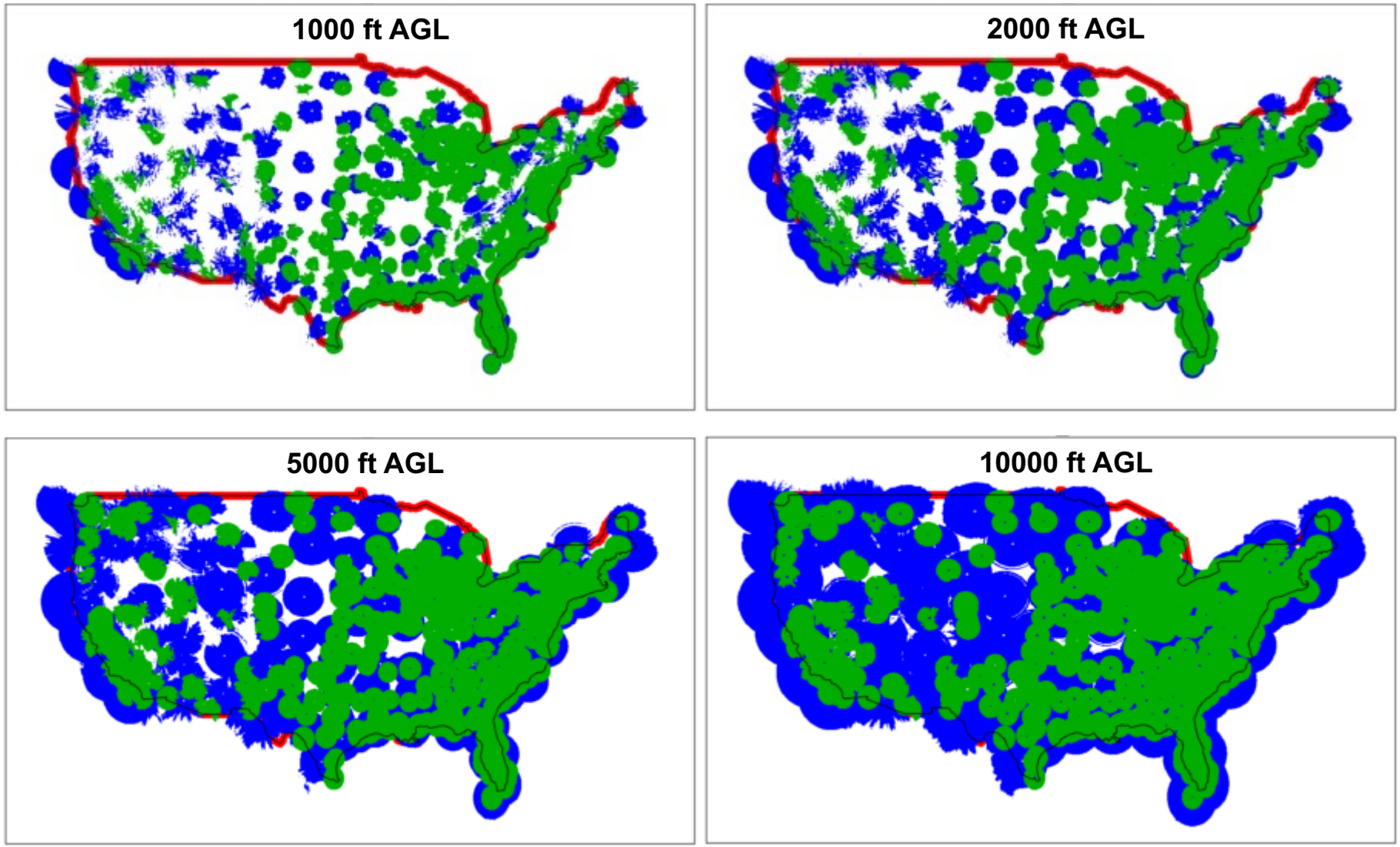
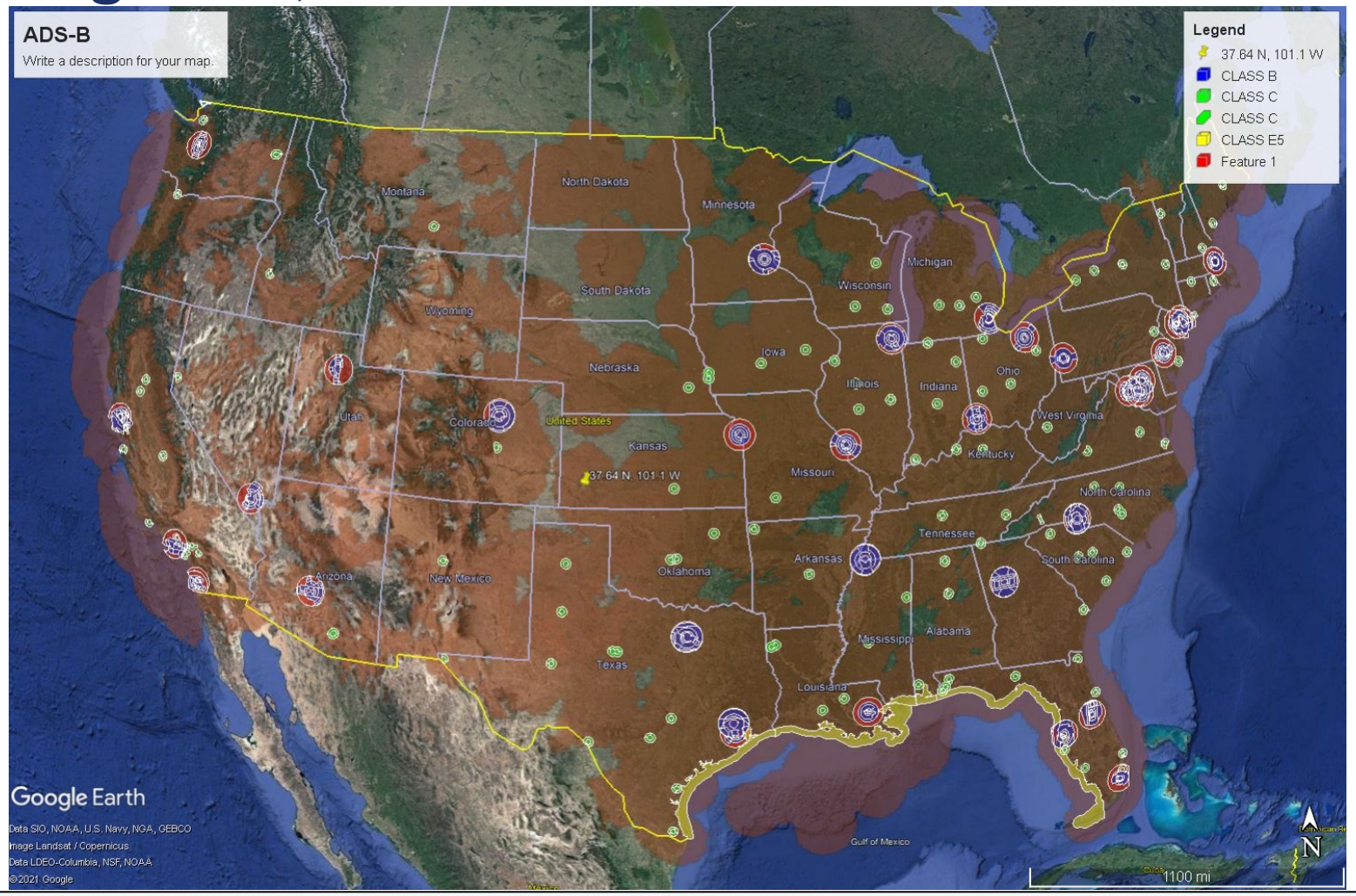
Radar Line of Sight Coverage Above Ground Level (AGL)

Non-Cooperative Long Range Radar Systems

Non-Cooperative Short Range Radar systems



ADS-B Coverage at 1,500 ft AGL



Significant ADS-B coverage exists across CONUS at 1,500 ft AGL